

FIONA: A laboratory microcosm for investigating natural populations of circumneutral, microaerobic Fe-oxidizing bacteria

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A flow-through microcosm system was developed that simulates naturally occurring conditions conducive to the growth of neutrophilic iron-oxidizing bacteria (FeOB). The system allows the growth of whole microbial communities, facilitating the examination of species which have historically proven impervious to traditional culturing methods. The microcosm consists of two separate anaerobic reservoirs attached to growth chambers with outflow tubing. Using peristaltic pumps, separate solutions of buffered growth medium and acidified FeCl₂ are fed into the growth chamber, mingling 3 cm before entering the chamber. Growth chambers consist of 30 ml chromatography columns. Environmental samples are inoculated onto a thin layer of glass beads at the bottom of each column. A constant flow rate is maintained such that each column receives approximately 500 μ M FeCl₂. Growth has been maintained for periods of up to three weeks, allowing for the examination of changes in community structure over time. Trials were run with both freshwater and marine samples.

Marine samples were obtained from a volcanic caldera (Pele's Pit) at the Loihi Seamount, (depth 1250m) in the Pacific Ocean. At the vent site, ferrous iron concentrations are typically in the 10s to 100s μ M. In the microcosm, the concentration of ferrous iron from the growth chamber was compared to that of a killed control. The control showed an average FeII concentration of 350 μ M, while the sample chamber had an average FeII concentration of 120 μ M. This indicates a level of biotic iron oxidation consistent with the presence of FeOB.

